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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/805,770	03/22/2004	Michael Durr	282743US8X	1234

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EXAMINER	
BENNETT, TYLER N	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
10/09/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/805,770	DURR ET AL.	
	Examiner	Art Unit	
	TYLER N. BENNETT	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4 and 6-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4 and 6-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. In response to applicant's phone call 29 Sep 2008 regarding the last Office action, the following corrective action is taken. The previous Office Action incorrectly cited Chiba et al. in the Rejection under U.S.C. 102. The Rejection should have cited Usami ("Theoretical study of application of multiple scattering of light to a dye-sensitized nanocrystalline photoelectrochemical cell", Chemical Physics Letters, 277, 1997, pp.105-108). This error has been corrected.

The period for reply of 3 MONTHS set in said Office Action is restarted to begin with the mailing date of this letter.

Response to Amendment

2. Applicant's amendment of 4/10/2008 does not render the case allowable.

3. Claims 1-2, 4 and 6-34 are pending. Applicant has amended claims 1, 4-14 and 16-18 and cancelled claims 3-5.

Requirement for Information

4. Applicant and the assignee of this application are required under 37 CFR 1.105 to provide the following information that the examiner has determined is reasonably necessary to the examination of this application.

In response to this requirement, please provide copies of each publication which any of the applicants authored or co-authored and which describe the disclosed subject matter of combining sensitizers with different absorption properties for solar cells. Requested is the published Master's thesis of Andreas Schmid from Reutlingen University in 2003 as cited in the article "Tandem dye-sensitized solar cell for improved

power conversion efficiencies" by M. Durr, A. Bamedi, A. Yasuda, and G. Nelles, Appl. Phys. Lett. 84, 3397 (2004).

In responding to those requirements that require copies of documents, where the document is a bound text or a single article over 50 pages, the requirement may be met by providing copies of those pages that provide the particular subject matter indicated in the requirement, or where such subject matter is not indicated, the subject matter found in applicant's disclosure.

The fee and certification requirements of 37 CFR 1.97 are waived for those documents submitted in reply to this requirement. This waiver extends only to those documents within the scope of this requirement under 37 CFR 1.105 that are included in the applicant's first complete communication responding to this requirement. Any supplemental replies subsequent to the first communication responding to this requirement and any information disclosures beyond the scope of this requirement under 37 CFR 1.105 are subject to the fee and certification requirements of 37 CFR 1.97.

The applicant is reminded that the reply to this requirement must be made with candor and good faith under 37 CFR 1.56. Where the applicant does not have or cannot readily obtain an item of required information, a statement that the item is unknown or cannot be readily obtained may be accepted as a complete reply to the requirement for that item.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 2, 4, 6-9 and 19-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Usami ("Theoretical study of application of multiple scattering of light to a dye-sensitized nanocrystalline photoelectrochemical cell", Chemical Physics Letters, 277, 1997, pp.105-108, cited in Applicant's IDS).

As to claim 1, the reference teaches a porous film of a solar cell photoelectrochemical cell (Abstract), comprising:

- a film (multilayered dye-sensitized film, pp. 106, col 1, line 2, Fig. 4) having a front face (top of first layer of particles, Fig. 4) and a back face (bottom of last layer of particles, Fig. 4), the film including at least two layers (multiple layers of small and large particles, Fig. 4),
- each layer having a first kind of particles of one average diameter or length (each layer has a layer of particles of one average diameter, Fig. 4) and one layer having additionally a second kind of particles having a larger average diameter or length (bottom two layers have a second kind of particle with a larger average diameter, Fig. 4 and pp. 107, 2:11-13), and

- the porous film has a gradient of light scattering strength extending from said front face to the back face, with the light scattering strength increasing towards the back face (scattering increases as particle diameter increases, Fig. 2 and larger particles are closest to the back face, pp. 107, 2:11-13).

Regarding claim 2, the reference teaches that the gradient of light scattering strength starts with zero light scattering at the front face (scattering intensity of the smallest particles, diameter of 0.7 π/k, is 0, Fig. 2).

Regarding claim 4, the reference teaches three layers (first two small particle layers and bottom large particle layer, Fig. 4), each layer having a first kind of one average diameter or length (each layer has a layer of particles of one average diameter, Fig. 4), and at least one layer having additionally a second kind of particles having a larger average diameter or length (bottom layer has a second kind of particle with a larger average diameter, Fig. 4 and pp. 107, 2:11-13).

Regarding claim 6, the reference teaches that the particles have a ball shape (pp. 106, 1:21 and Fig. 4).

Regarding claim 7, the reference teaches that the particles are metal particles (TiO_2 particles, pp. 105, 1:9).

Regarding claims 8-9, the reference teaches at least two subsequent layers (Fig. 4). The Examiner notes that claims 8-9 are product by process claims and that the determination of patentability is based on the product, and not on the method of making the product. “Even though product-by-process claims are limited by and defined by the

process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process" - MPEP §2113 [R-l] Product-by-Process Claims. See also *In re Thorpe*, 777F.2d 695, 698, 227 USPQ 964,966 (Fed. Cir. 1985).

In regard to claims 19-24, the reference teaches that the porous film is used in a solar cell (photoelectrochemical cell, title), comprising a porous film (col. 1; paragraph !, p. 105), an electrolyte (Figure 4), a reflective back electrode (co1.2; paragraph 2, p. 108 and Figure 4), and a light confinements layer (col.2; paragraph 2, p. 108).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 9-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usami as applied to claims 1 and 8 above, and further in view of Chone (EP 1,271,580, cited in Applicant's IDS).

As to claim 9-14, Usami discloses the porous film according to claim 8, but fails to disclose that the at least two/three/plurality of layers have been applied subsequently by a technique selected from the group comprising screen printing, doctor blading, drop casting, spin coating, sol gel process and lift-off techniques, and any combination of the aforementioned techniques. Usami further fails to disclose the first kind of particles have an average diameter in the range of from 2 nm to 25 nm, preferably from 3nm to 20 nm, or they have an average length of from 3 nm to 300 nm, preferably from 10nm to 100 nm and a second kind of particles have an average diameter or length in the range of from 50 nm to 1 lam; preferably from 100 nm to 500 nm, more preferably from 200 nm to 400 nm.

Chone discloses a porous photoelectrochemical film with metal oxide (Ti02) particles (abstract & paragraph 31) and further discloses that the layers have been applied by drop casting and doctor blading (paragraph 40). Chone discloses that the smaller particle size ranged from 10-30nm and the larger sizes ranges from 100-200nm with volume a ratio of 10:1 of a big to small particle (assuming the comparison of the same individual particle for the volume ratio the weight ratio would be the same, paragraph 26). Chone teaches that the drop drying and doctor blade method utitlized to obtain a film that had a particle size distribution (paragraph 40). Also, Chone further teaches that the particle distribution allows an improvement of the photon conversion

efficiency of the cell by keeping the dye absorption area and by improving the light scattering effect (paragraph 27). It would have been obvious to one of ordinary skill in ' the art at the time of the invention to incorporate a drop casting and doctor blading technique as taught by Chone to the porous film of Usami in order to form a particle distribution to allow an improvement of the photon conversion efficiency of the cell by keeping the dye absorption area and by improving the light scattering effect.

In regard to claim 15, Usami discloses the porous film according to claim 1, and further discloses in Figure 4 that one layer is composed of larger/a first kind of particles not incorporating into the layer of smaller/a second kind of particles, wherein the smaller particles are composed of another layer without the incorporation of the larger particles, but fails to disclose each layer having a first kind of particles of one average diameter, wherein in each of the layers having a second kind of particles, either i) the average diameter of the second kind of particles is the same in each layer and the amount of the second kind of particles present in each layer varies from layer to layer, or (ii) the amount of the second kind of particles present in each layer is the same in each layer and the average diameter of the second kind of particles varies from layer to layer.

Chone discloses a porous photoelectrochemical film with metal oxide (Ti02) particles (abstract & paragraph 31) and further discloses in Figure 1, within the three levels/layers of metal oxide particles each layer has larger/a first kind of particles intermixed with smaller/a second kind of particles (particle distribution of sizes within each lever/layer- paragraph 32) (abstract & paragraph 22). Chone depicts in Figure 1 that the average diameter 30-50nm (paragraph 22) of the second kind of particles is the

same in each layer and the amount/density of the second kind of particles present in each layer varies from layer to layer (paragraph 60). Chone teaches that small particles of sizes lower than 30 nm and big particles of sizes higher than lOO nm are such that they allow an improvement of the photon conversion efficiency of the cell by keeping the dye absorption area and by improving the light scattering effect (paragraph 27). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a plurality or three layers of a first and second kind of particle diameters (particle distribution) as taught by Chone to the porous film of Usami in order to that the big and small particles allow to improve the photon conversion efficiency of the cell by keeping the dye absorption area and by improving the light scattering effect.

With respect to claim 16, Usami discloses the porous film according to claim 15, but fails to disclose wherein the amount of the second kind of particles present in each layer varies from layer to layer, it increases from layer to layer, and where the average diameter of the second kind of particles present in each layer varies from layer to layer, it increases from layer to layer.

Chone discloses a porous photoelectrochemical film with metal oxide (TiO2) particles (abstract & paragraph 31) and further discloses metal oxide particles each layer has larger/a first kind of particles intermixed with smaller/a second kind of particles (particle distribution of sizes within each lever/layer- paragraph 32) (abstract & paragraph 22). Chone further discloses within the three two layers of metal oxide particles each layer having a more dense layer than that of a less dense second layer closer to the cathode (paragraph 60). Chone teaches that denser layers (the number of

particles in confinement increasing layer to layer) can have an improved dye adsorption in the layer close to the TCO/glass substrate and the redox couple diffusion flow can be improved in the second layer close to the cathode electrode therefore the current in the photoelectrochemical cell will flow without any restraint of the ionic flow also to enhance the light scattering effect (paragraph 60). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a more dense layer that the second layer closer to the cathode with a less dens layer as taught by Chone to the porous film of Usami in order to have denser layers (the number of particles in confinement increasing layer to layer) with improved dye adsorption in the layer close to the TCO/glass substrate such that the redox couple diffusion flow can be improved in the second layer close to the cathode electrode therefore the current in the photoelectrochemical cell will flow without any restraint of the ionic flow also to enhance the light scattering effect.

As to claims 17-18, Usami discloses the porous film according to claim 15, characterized in that the one layer having only a first kind of particles is closer to said front face of said porous film than to said back face and is adjacent to said front face as shown in Figure 4.

Response to Arguments

10. Applicant's arguments filed 4/10/2008 have been fully considered but they are not persuasive. Applicant argues on pages 8-9 of the Remarks that the cited reference of Usami does not disclose that the "porous film includes at least two layers, each layer having a first kind of particle of one average diameter or length and one layer having

additionally a second kind of particle having a larger average diameter or length, as recited in Claim 1." However, in Figure 4 Usami discloses at least ten distinct layers of particles, the first eight of which are of the same particle size whereas the bottom two layers are of a much larger size (pp. 107, 2:11-13). Since the first two layers of Usami have a "first kind of particle of one average diameter" and the bottom layer (tenth layer of particles in Fig. 4) has a "second kind of particle having a larger average diameter", Usami teaches all of the limitations of Claim 1.

Applicant argues on page 8 that Usami does not disclose at least two layers with one type of particle being present in "all of the layers" and again on page 9 that Usami does not disclose a "mixture of at least two species of particles in one layer, wherein the one species having the smaller diameter or length is also present in all other layers." In response, the Examiner notes that the features upon which Applicant relies (i.e. a mixture of small and large particles in the same layer) are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Thus, Applicant's arguments are not commensurate in scope with the claims.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion of Office Action that Includes Requirement

This Office action has an attached requirement for information under 37 CFR 1.105. A complete reply to this Office action must include a complete reply to the attached requirement for information. The time period for reply to the attached requirement coincides with the time period for reply to this Office action.

Correspondence/Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TYLER N. BENNETT whose telephone number is (571)270-5260. The examiner can normally be reached on Mon-Thurs 0830-1800.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached at 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/T. N. B./
Examiner, Art Unit 1795

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1795